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This annual report is the second annual report in this series.

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FIELD	GROUP	SUB-GROUP	Tracking Stations Nova Satellite Ephemeris Availability
8	5		Tracking Network Oscar Satellite Time Stability
			Transit Satellite Doppler Polar Positions

ANNUAL REPORT ON

DMA ORBIT DETERMINATION OF THE

NAVY NAVIGATION SATELLITE SYSTEM

1986

J. KENNETH MURPHY

ROBERT J. JONES

DEFENSE MAPPING AGENCY

WASHINGTON, DC 20305 - 3000 USA

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INTRODUCTION

The Defense Mapping Agency Hydrographic/Topographic Center (DMAHTC) performs precise orbit computations for Navy Navigation Satellite System (NNSS) satellites, also called TRANSIT, using Doppler observations collected by a worldwide network of stations. Equipment at these sites is configured around either a Tranet II or a Magnavox 1502 DS receiver. Table 1 lists the current stations while Figure 1 shows the tracking network configuration. Recorded Doppler counts, surface weather measurements, and other appropriate data are transmitted daily via satellite communications or over other telecommunication links to DMAHTC for processing, time corrections and orbit determination. There are two classes of NNSS satellites - the "Oscar" and the "Nova". The Nova satellites represent the latest generation of TRANSIT satellites. For Nova satellite 30480 and Oscar satellites 30110, 30130, 30200 and 30300, data were processed in two-day fits. For Nova satellite 30500, data were processed in one-day fits. Table 2 and Figure 2 provide additional information on these satellites.

1986 TRACKING STATIONS

1502 DS Stations

Station Number	Station Location
30690	Herndon, Virginia
35000	Ascension Island
35004	St. Helena Island
35006	Dhekelia, Cyprus
35007	Ewa Beach, Hawaii
35010	Diego Garcia Island
35011	Cambridge Bay, Canada
35012	Bahrain, Persian Gulf
35013	Asuncion, Paraguay
35015	Wichita Falls, Texas
35017	Sioux City, Iowa
35018	Shemya, Alaska
35021	Las Cruces, New Mexico
35022	Quito, Ecuador
35024	Sigonella, Italy
35025	Santiago, Chile
35026	Kinshasa, Zaire
35027	Aurora, Colorado
35028	Bangkok, Thailand
35029	Rapid City, South Dakota
35036	Idaho Falls, Idaho
35037	Flagstaff, Arizona
35038	NAS Fallon, Nevada
35039	NAS Meridian, Mississippi
35040	Grissom AFB, Indiana

Tranet II Stations

545	Smithfield, Australia
547	Brussels, Belgium
548	Mizusawa, Japan
549	Wettzell, West Germany
550	Herndon, Virginia
552	Las Cruces, New Mexico
553	Guam (U.S.)
554	Pretoria, South Africa
555	Sao Jose, Brazil
556	Anchorage, Alaska
557	Thule, Greenland
558	Mahe, Seychelles
559	San Miguel, Philippines
560	Tafuna, American Samoa
561	Austin, Texas
562	McMurdo, Antarctica
563	Calgary, Canada
564	Ottawa, Canada
567	Kerguelen Island
568	Papeete, Tahiti
570	Hermitage, United Kingdom
590	San Fernando, Spain
591	Kourou, French Guiana

FIGURE 1: 1986 TRACKING NETWORK

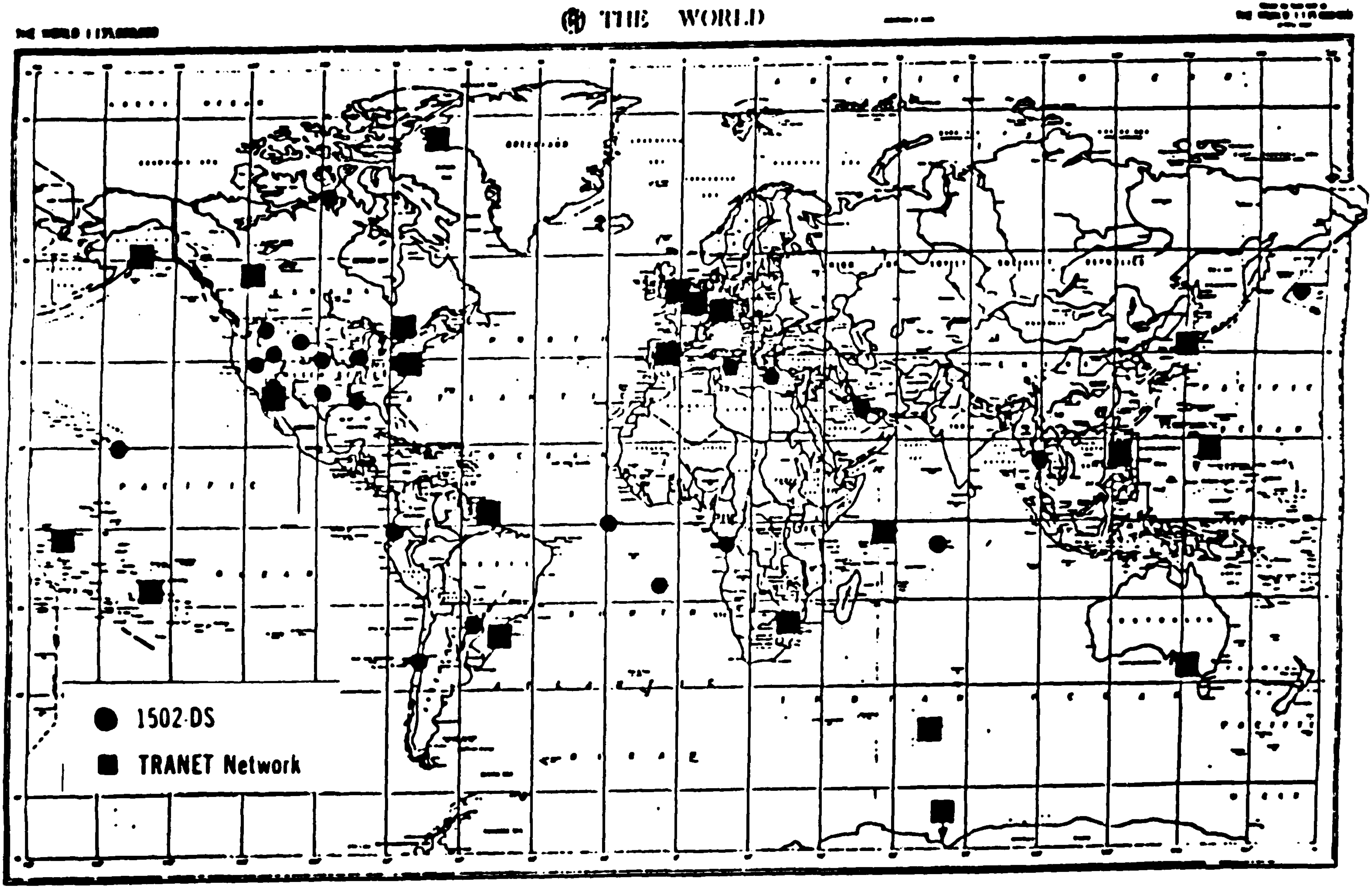
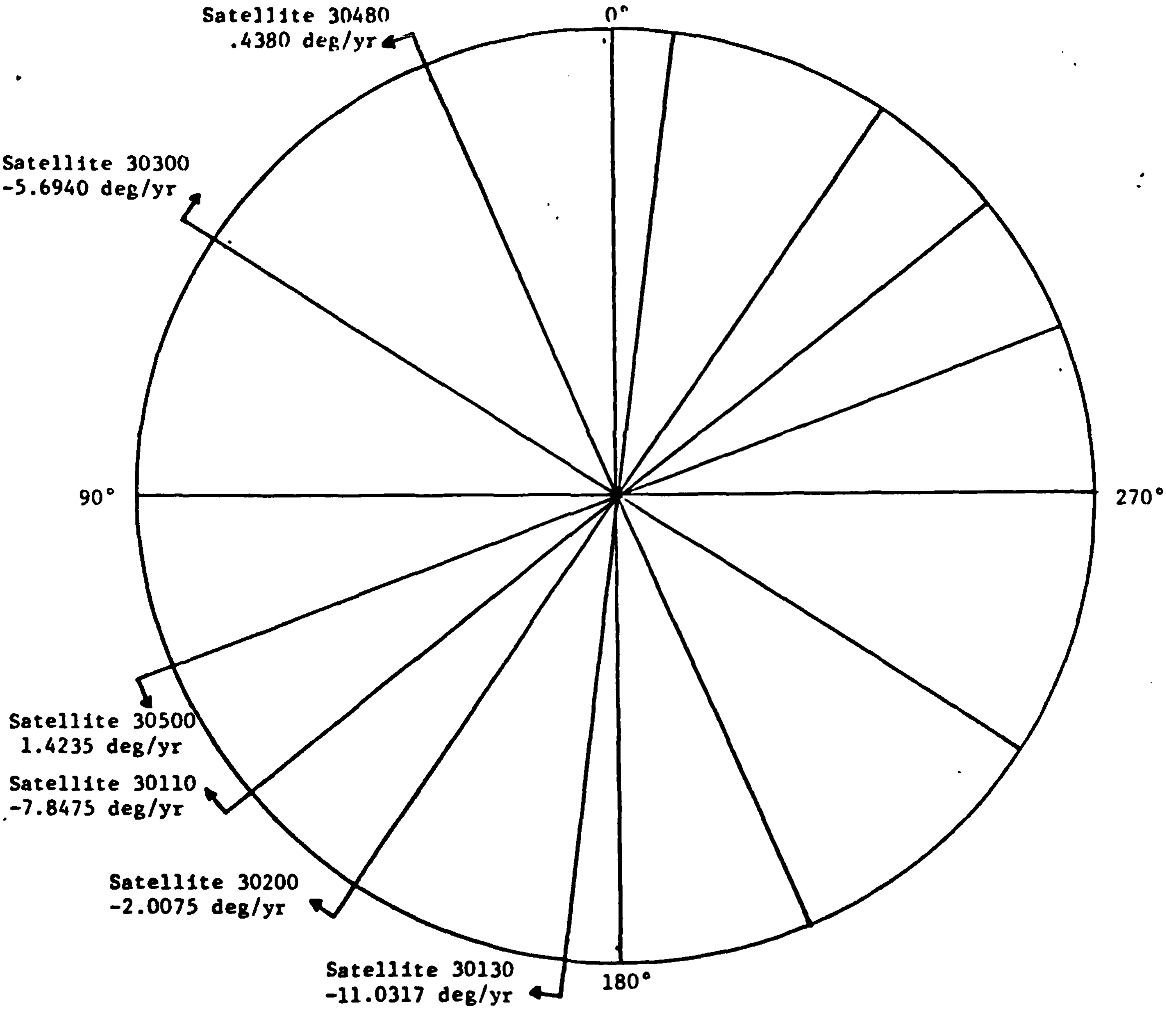


TABLE 2: STATUS REPORT ON USABLE SATELLITES AS OF DECEMBER 1986

TRANSIT Satellite Number	Launched	Status
30130	18 May 1967	Operational for 234 months
30200	29 Oct 1973	Operational for 157 months
30110	28 Oct 1977	Operational for 109 months
30480	15 May 1981	Operational for 64 months
30500	12 Oct 1984	Operational for 24 months
30300	3 Aug 1985	Operational for 16 months

These satellites are controlled by the Navy Astronautics Group (NAG) headquartered at Point Mugu, California.

FIGURE 2: TRANSIT ORIENTATION CHART



Right Ascension Epoch 86342

EPHEMERIDES

Orbits for the six TRANSIT satellites were computed in 1986 on a one-day or two-day basis as previously mentioned, using the CELEST orbit determination program. Ephemerides were computed for the days provided in Table 3.

The orbit computation program provides sufficient diagnostic information to judge the overall quality of estimated ephemerides, the stability of satellite and tracking station clocks, and the performance of the tracking network. One quantity computed within the CELEST program, used as a measure of ephemeris quality, is the station navigation solution. After the satellite ephemeris is estimated, each individual pass of Doppler data acquired during the fit span is used to adjust the geodetic coordinates of the tracking station in directions along and perpendicular to the slant range vector to the satellite at its time of closest approach during the pass. These individual two - parameter station adjustments provide a measure of the consistency of the data with the estimated ephemeris. From these station navigation estimates, a weighted root mean square (RWS) is computed, where the weighting factor for each pass is chosen as the variance of the pass navigation solution.

Table 4 provides the average of the RWS station navigation results for all orbit determinations computed during 1986. These average values, labeled tangential (along - track direction) and radial (slant - range direction), are a measure of the internal consistency of computed ephemerides with the acquired Doppler data.

A measure of orbit repeatability can be obtained by comparing the estimated satellite position at the beginning of each fit span with the estimated satellite position at the end of the previous span. These comparisons are made in the radial, tangential and normal directions using the satellite position and velocity vectors to define the coordinate system. Averages for these quantities for the year 1986 are found in Table 4 under orbit consistency.

TABLE 3: 1986 TRANSIT EPHEMERIS AVAILABILITY

TRANSIT Satellite Number	Day Numbers
30110	1 - 365
30130	1 - 365
30200	1 - 98, 101 - 152, 155 - 365
30300	154 - 365
30480	1 - 365
30500	1 - 365

TABLE 4: SUMMARY OF EPHEMERIS QUALITY
UNITS: METERS

	SATELLITE 30110			SATELLITE 30130			SATELLITE 30200		
	TANGENTIAL	RADIAL	NORMAL	TANGENTIAL	RADIAL	NORMAL	TANGENTIAL	RADIAL	NORMAL
DATA CONSISTENCY	2.4	2.2		1.9	2.4		2.0	2.4	
ORBIT CONSISTENCY	8.0	1.2	1.4	2.7	0.7	1.3	3.3	0.8	1.3

	SATELLITE 30300			SATELLITE 30480			SATELLITE 30500		
	TANGENTIAL	RADIAL	NORMAL	TANGENTIAL	RADIAL	NORMAL	TANGENTIAL	RADIAL	NORMAL
DATA CONSISTENCY	1.6	1.6		1.6	1.6		1.3	1.1	
ORBIT CONSISTENCY	3.0	0.9	0.9	2.2	0.7	1.5	2.2	0.5	0.9

TIME STABILITY

Time stability for the Navy Navigation Satellite System is maintained through the operations of the Naval Astronautics Group at Point Mugu, California. Time is maintained for Oscar satellites through the deletion of cycle counts generated by a satellite crystal oscillator operating at a frequency slightly above a nominal frequency. Fractional frequency fluctuations are compensated for by estimating oscillator instability and by adjusting cycle counts appropriately. An actual time drift will still occur; however, the time error will be maintained within prescribed limits. For Nova satellites time stability is maintained by varying the frequency of the satellite crystal oscillator. This frequency steering occurs daily, as necessary, for 30500 but is not used on 30480 due to a partial failure of the frequency steering mechanism.

As part of the DMAHTC orbit determination solution, satellite frequency bias and drift are estimated. Frequency bias causes a time drift to occur equal to the ratio of the frequency bias to oscillator base frequency multiplied by the effective time span of the bias. Frequency drift causes a quadratic time error equal to the ratio of the frequency drift to oscillator base frequency multiplied by one - half the square of the effective time span of the drift. The long - term frequency stability for the Navy navigation satellites was calculated using the estimated daily frequency bias from CELEST orbit processing. Since this value is readily available on a one or two - day basis, long - term trends in frequency stability were obtained. Figures 3 through 6 give the plots of estimated frequency bias for Oscar satellites 30110, 30130, 30200 and 30300 respectively. Figure 7 gives similar results

for Nova satellite 30480. Based on these data, average annual frequency drifts for each satellite were computed and are given in Table 5.

FIGURE 3: SATELLITE 30110 FREQUENCY ERROR

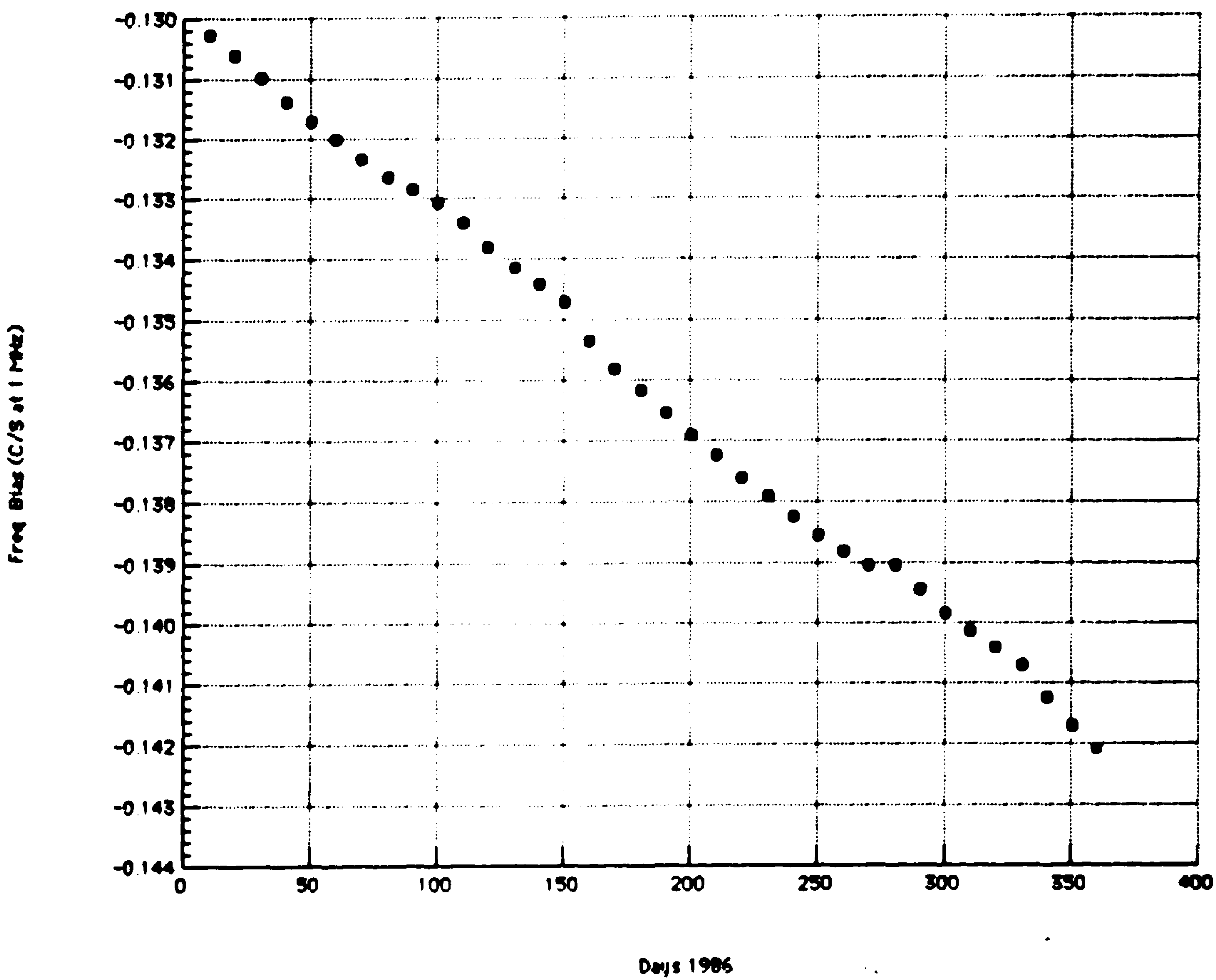


FIGURE 4. SATELLITE 30130 FREQUENCY ERROR

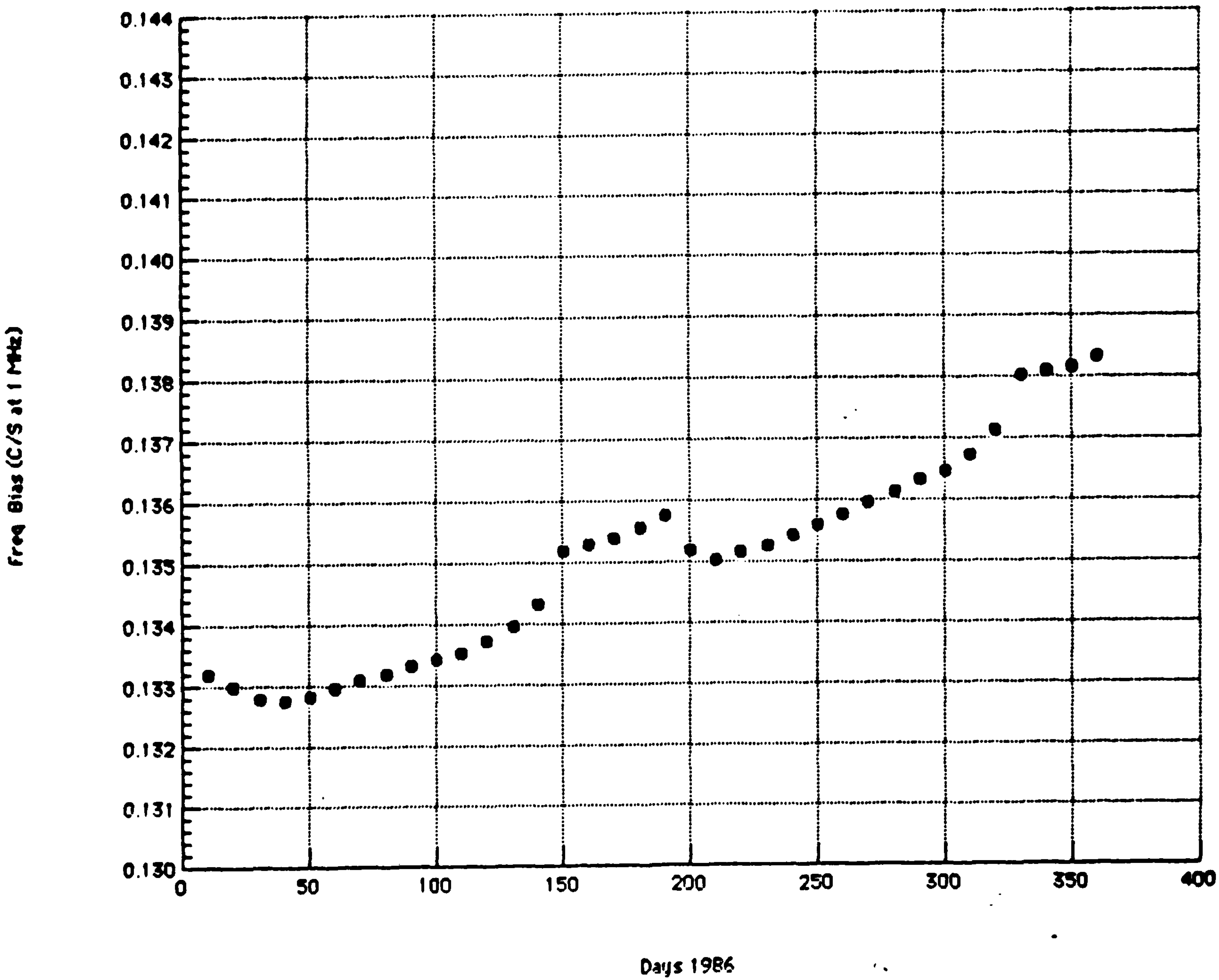


FIGURE 5: SATELLITE 30200 FREQUENCY ERROR

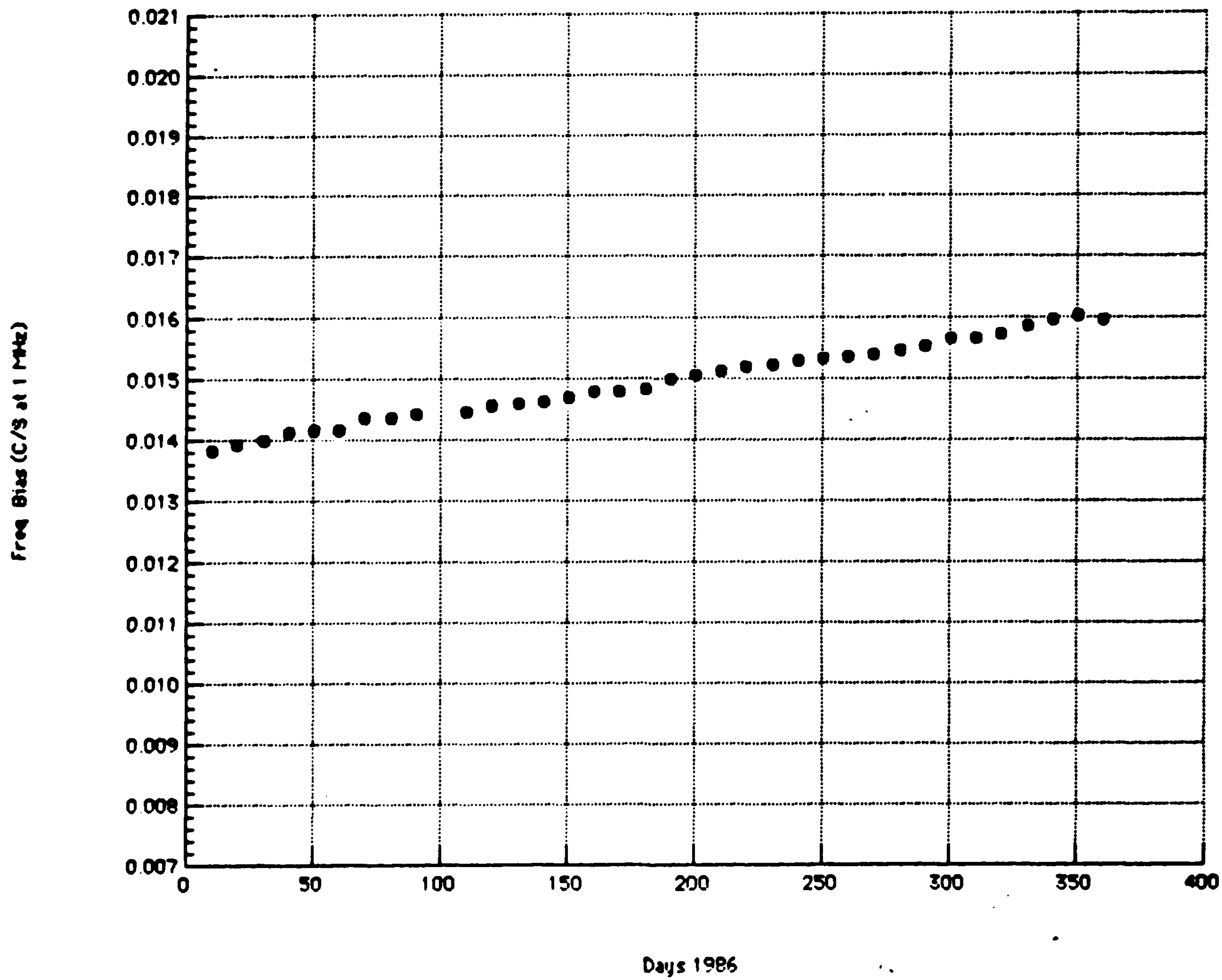


FIGURE 6: SATELLITE 30300 FREQUENCY ERROR

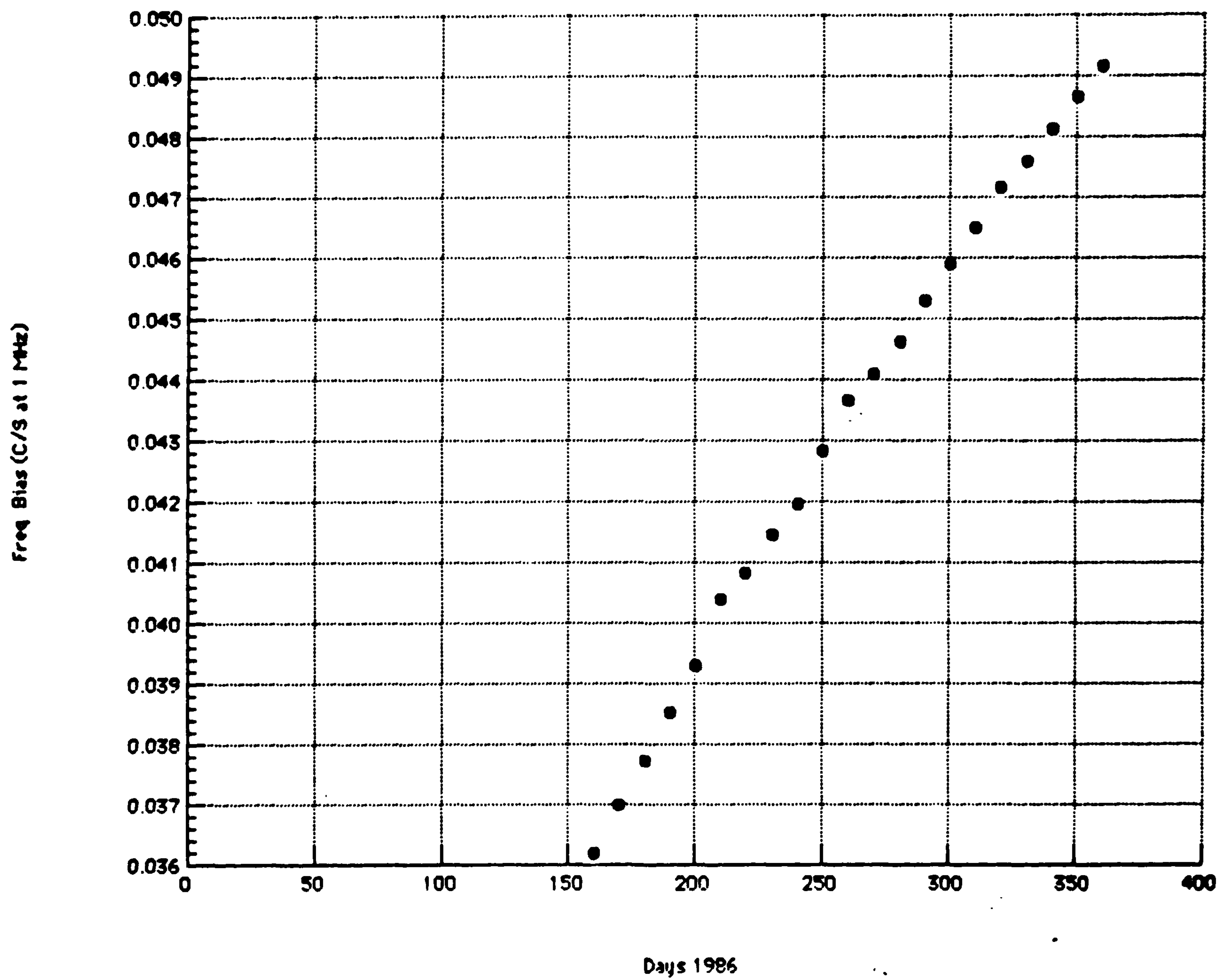


FIGURE 7: SATELLITE 30480 FREQUENCY ERROR

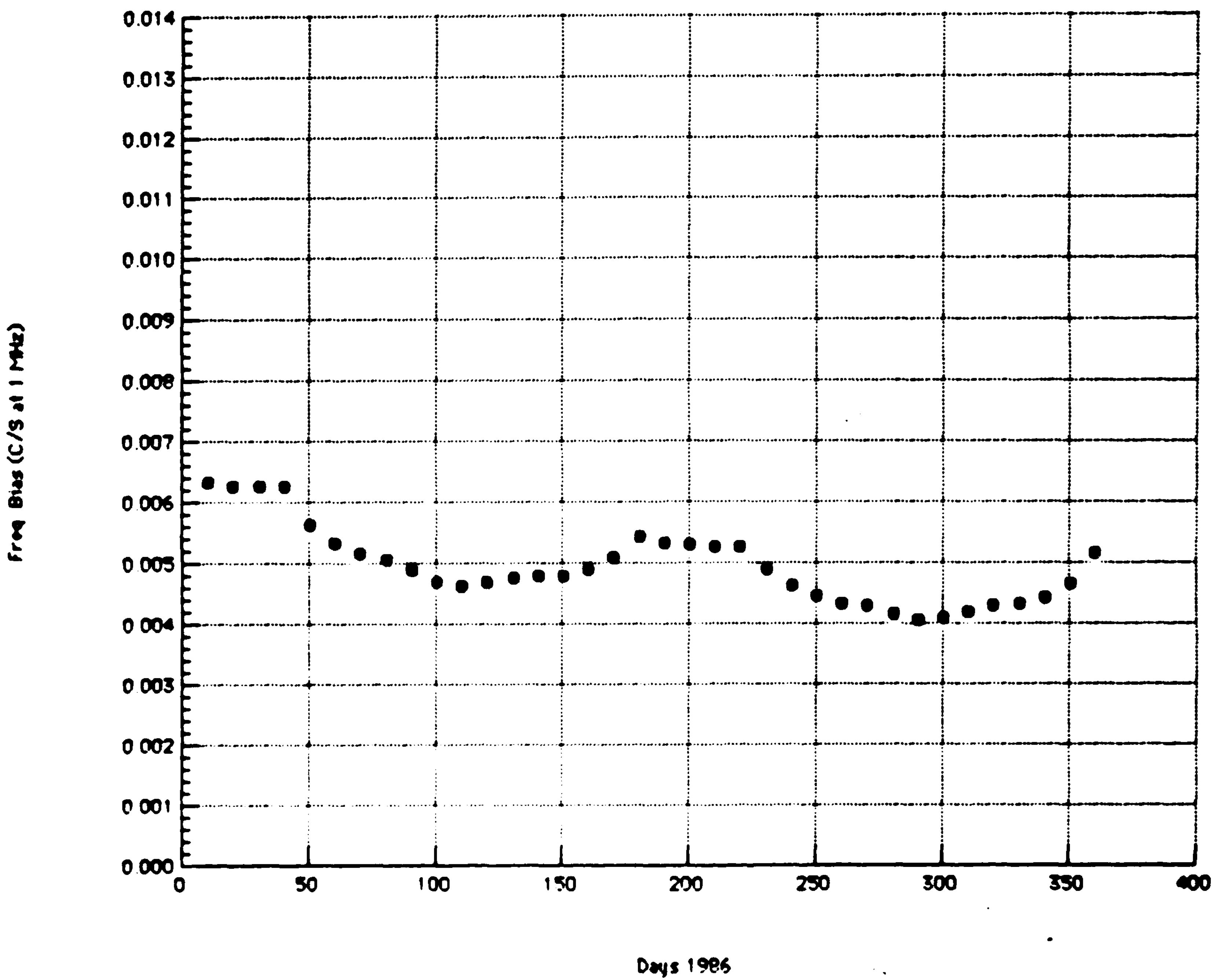


TABLE 5: 1986 MEAN FREQUENCY STABILITY

TRANSIT Satellite Number	Daily Mean Drift *
30110	-37×10^{-5}
30130	36×10^{-5}
30200	40×10^{-6}
30300	11×10^{-5}
30480	13×10^{-6}
30500	**

* Units: Cycles per second per day at 1 MHz

** Stability is maintained by active frequency steering.

POLAR MOTION

Included among the parameters estimated in the orbit determination program is the position of the Earth's spin axis with respect to the pole of the adopted Naval Surface Weapons Center (NSWC) 9Z - 2 terrestial frame. The scheme used to compute daily pole values is as follows: each satellite for which two-day spans of data are used for orbit determination is designated to have an odd or even starting day number. Consequently, for each day of the year, pole positions are determined using less than six satellites. The fit span and two-day designator are provided in Table 6 for each satellite. Satellite data processed daily produce pole position estimates on both odd and even days. Figures 8 through 13 are plots of the 1986 DMAHTC Doppler pole position values for each NNSS satellite. Much of the detail of the plot for Nova satellite 30500 is lost due to the density of data points and their scatter. Table 7 is a comparison of Doppler and BIH polar motion values for 1986.

TABLE 6: 1986 POLAR MOTION PROCESSING SCHEME

TRANSIT Satellite Number	Processing Interval (Days) One - Day	Processing Interval (Days) Two - Day	Designator
30110	----	1 - 365	Even
30130	----	1 - 365	Even
30200	----	1 - 98 101 - 152 155 - 365	Odd
30300	----	154 - 365	Even
30480	----	1 - 365	Odd
30500	1 - 365	----	Even, Odd

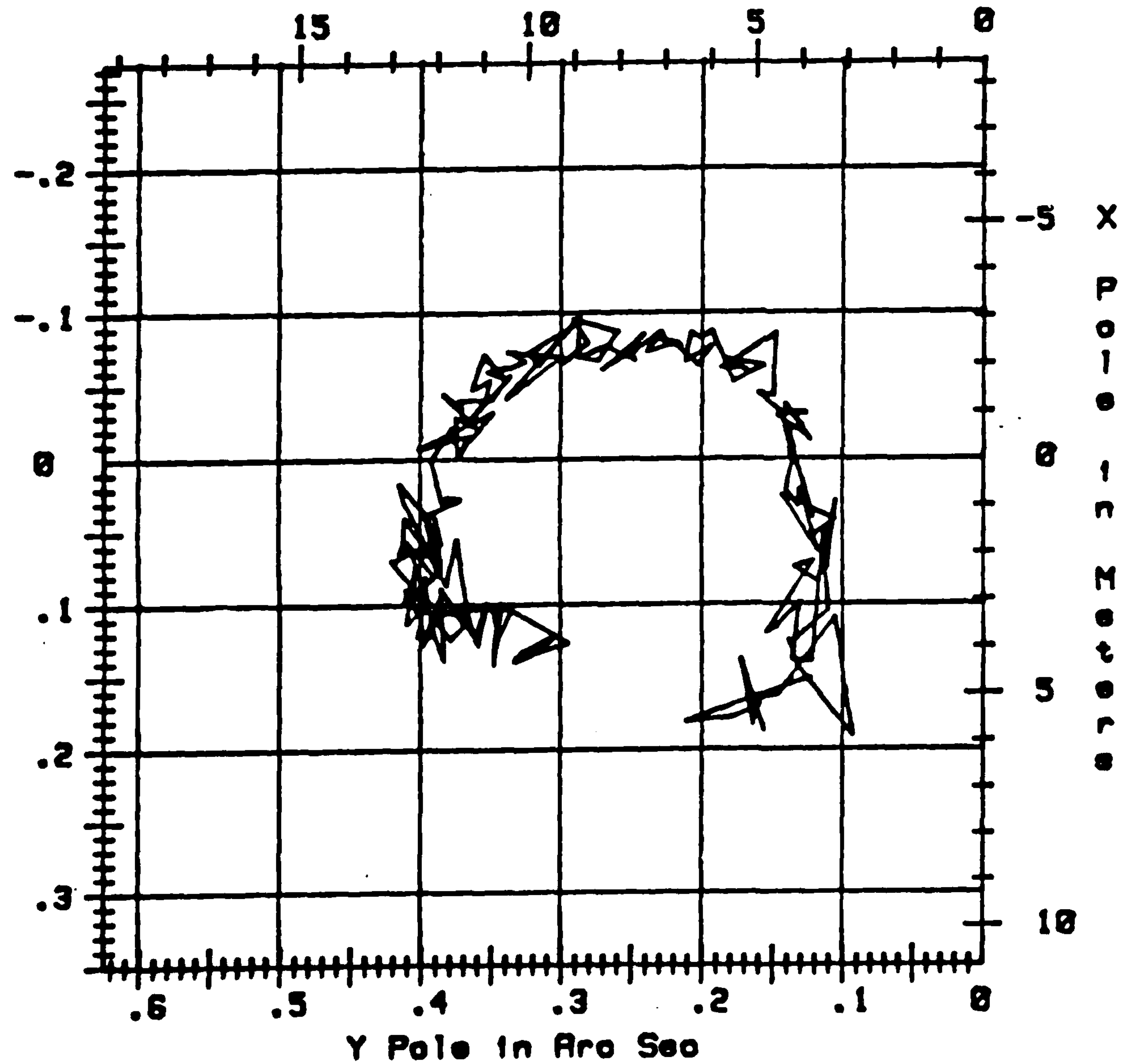


FIGURE 8:
SATELLITE 30110
DOPPLER POLAR MOTION
RESULTS DURING
1986

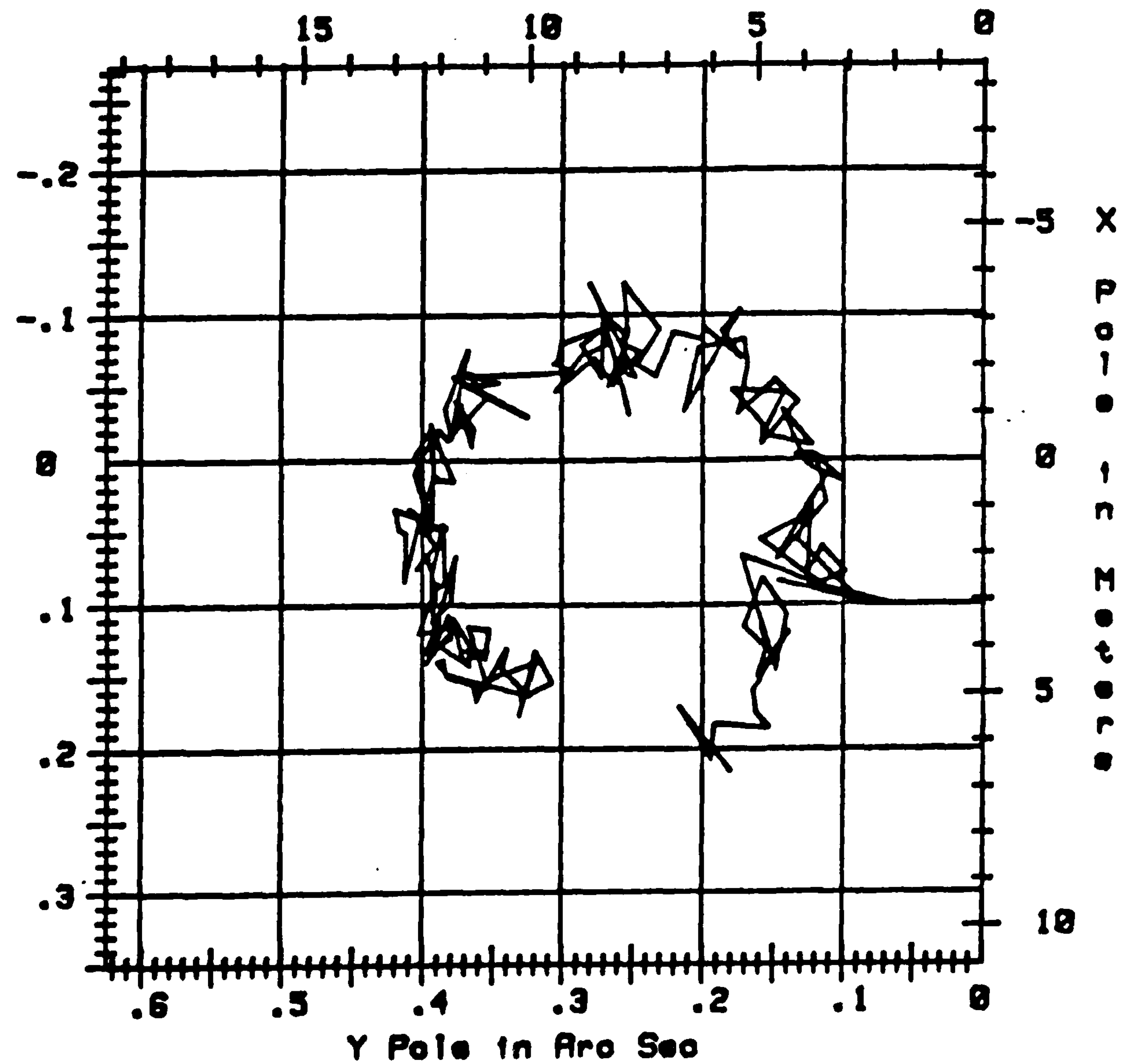


FIGURE 9:

SATELLITE 30130 DOPPLER POLAR MOTION RESULTS DURING 1986

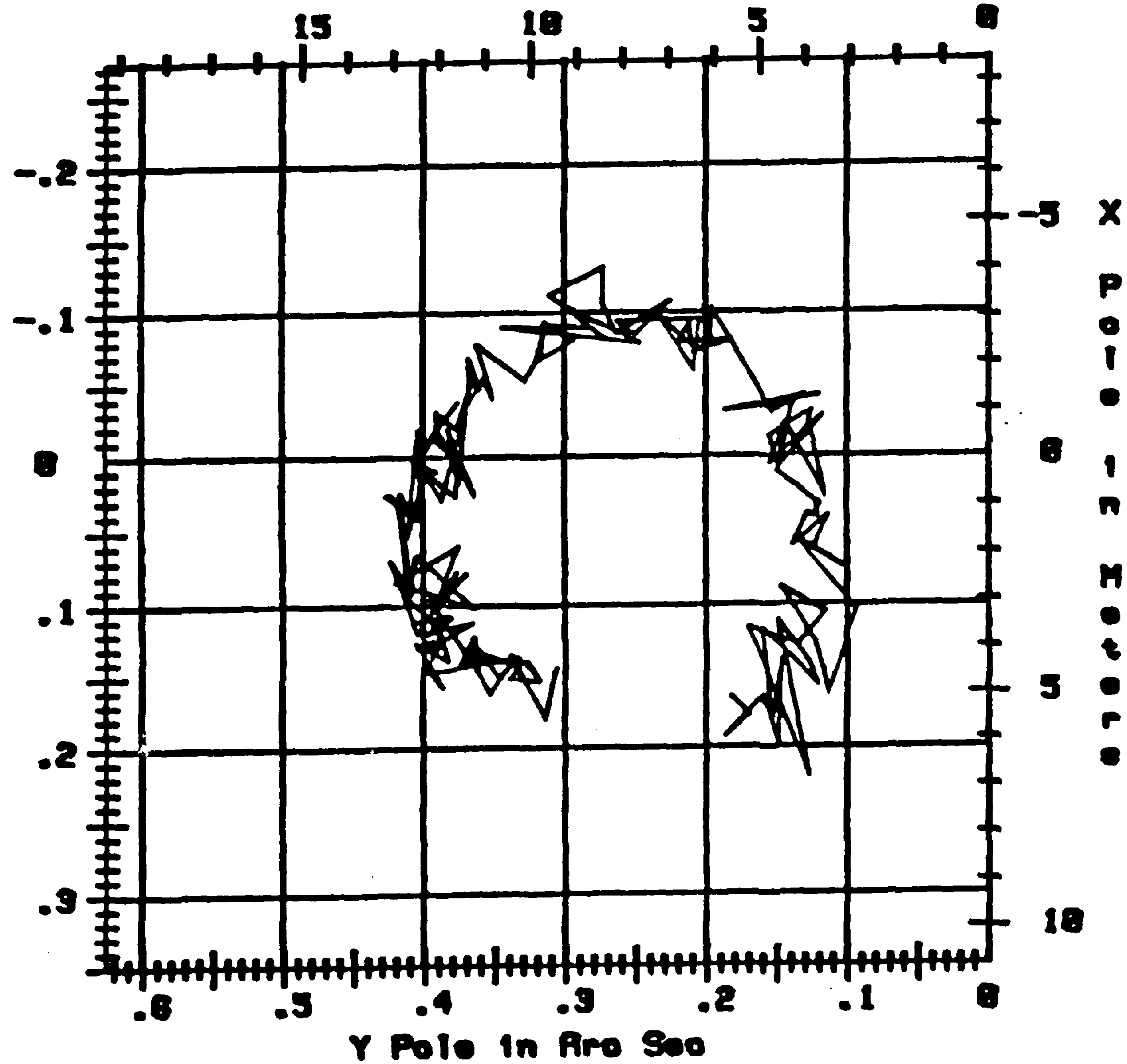


FIGURE 10:
SATELLITE 30200
DOPPLER POLAR MOTION
RESULTS DURING
1986

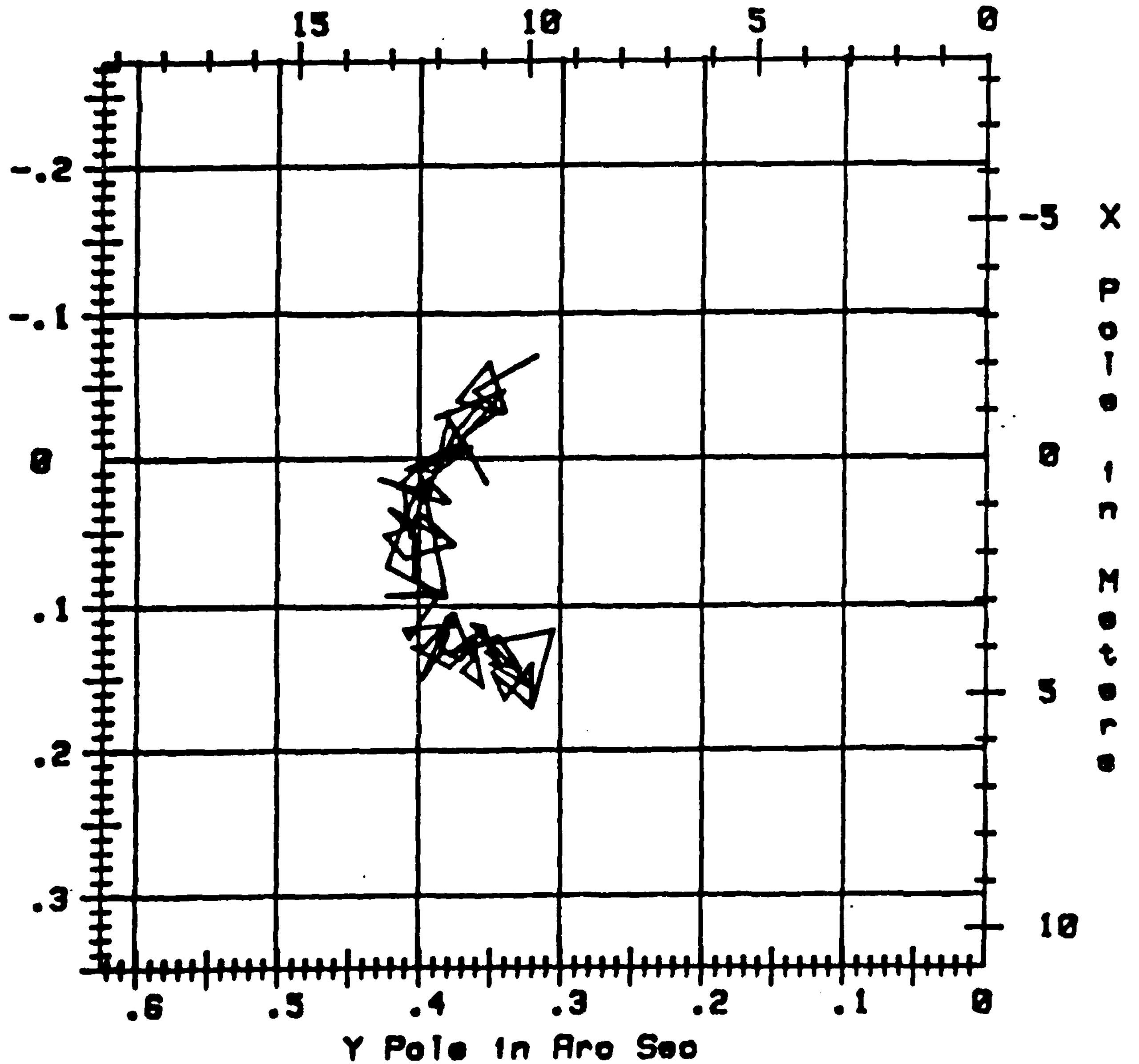


FIGURE 11:
SATELLITE 30300
DOPPLER POLAR MOTION
RESULTS DURING
1986

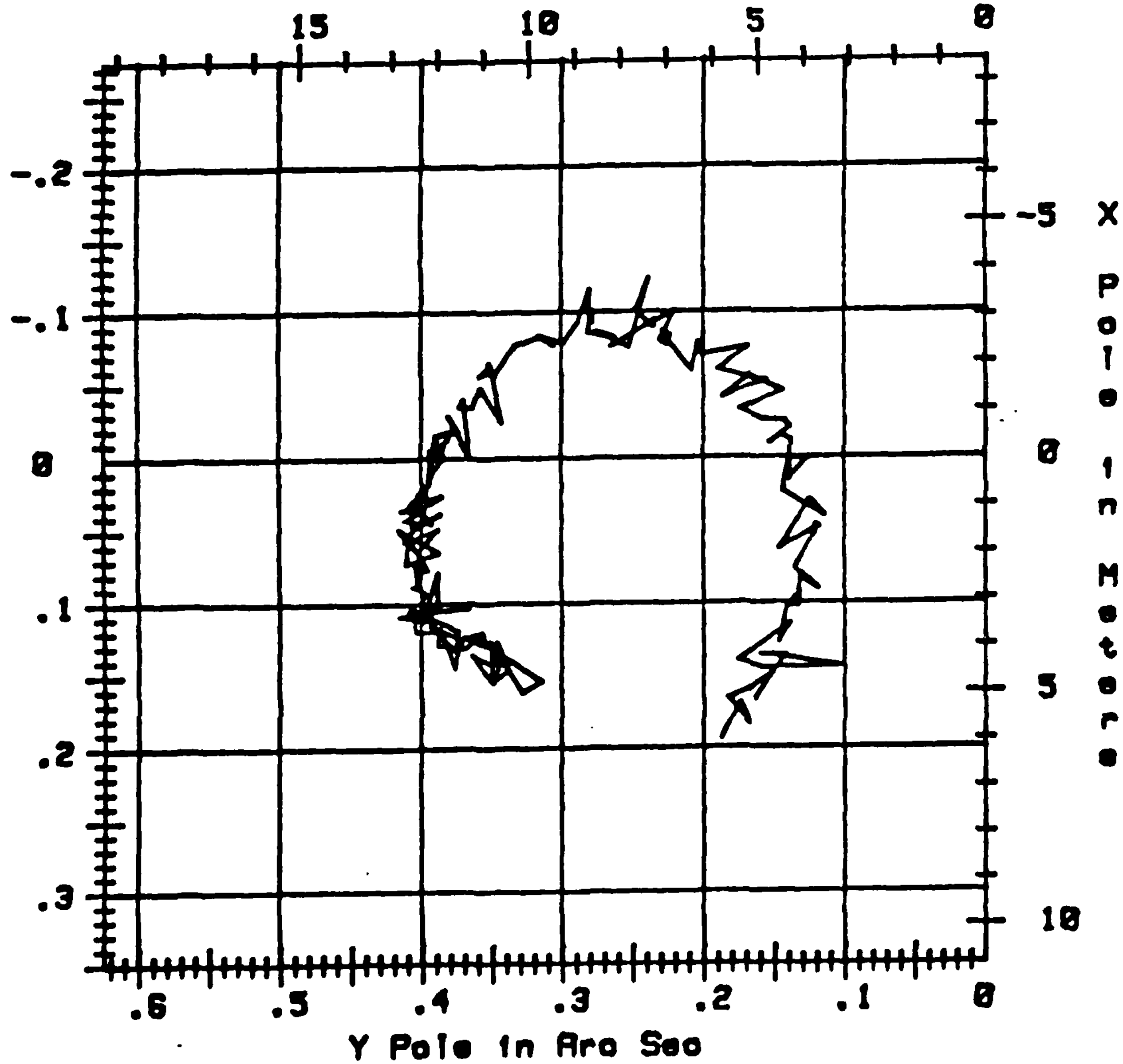


FIGURE 12:

SATELLITE 30480
DOPPLER POLAR MOTION
RESULTS DURING
1986

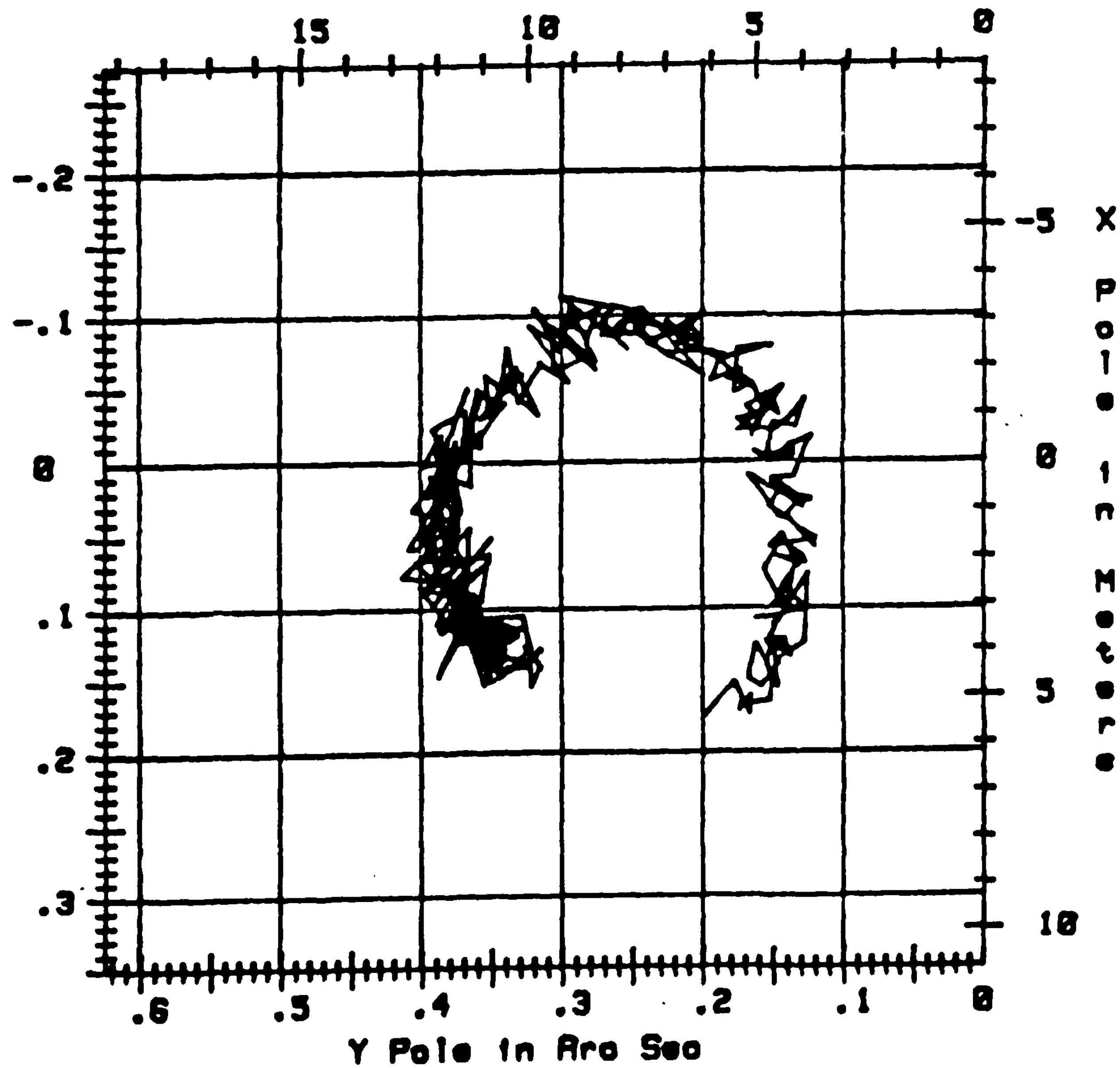


FIGURE 13:
SATELLITE 30500
DOPPLER POLAR MOTION
RESULTS DURING
1986

TABLE 7. COMPARISON OF DOPPLER AND BIH POLAR MOTION 1986

TRANSIT Satellite Number	X Component Mean*	X Component RMS	Y Component Mean*	Y Component RMS	Number of Spans
30110	.0082	.0214	.0074	.0184	132
30130	.0045	.0223	.0100	.0222	135
30200	.0043	.0211	.0100	.0184	110
30300	.0055	.0154	.0012	.0151	41
30480	.0013	.0114	.0112	.0159	116
30500	.0069	.0237	.0134	.0214	264

* Mean of Doppler minus BIH

Units are arc seconds.

ACKNOWLEDGEMENTS

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APPENDIX

DMAHTC POLE POSITION VALUES

1986

DMAHTC POLE POSITION VALUES
UNITS: ARC SECONDS

		X POLE (ARCSECS)							Y POLE (ARCSECS)					
YEAR	DAY	30110	30130	30200	30300	30480	30500	!!	30110	30130	30200	30300	34800	30500
86	1	.151	.215				.175	!!	.124	.181				.199
86	2	.181	.171				.152	!!	.211	.216				.178
86	3			.164		.194	.174	!!			.183		.188	.167
86	4	.177	.208				.162	!!	.179	.194				.166
86	5			.178		.170	.171	!!			.170		.175	.174
86	6	.175	.183				.165	!!	.171	.192				.172
86	7			.192		.184	.167	!!			.187		.168	.167
86	8	.168	.184				.164	!!	.159	.176				.152
86	9			.164		.166	.146	!!			.160		.183	.150
86	10	.184	.185				.153	!!	.164	.154				.146
86	11			.198		.160	.125	!!			.149		.169	.163
86	12	.138	.174				.150	!!	.173	.163				.168
86	13			.137		.148	.155	!!			.147		.152	.159
86	14	.187	.159				.139	!!	.157	.164				.146
86	15			.185		.167	.122	!!			.154		.164	.155
86	16	.165	.119				.130	!!	.163	.140				.140
86	17			.116		.136	.128	!!			.161		.143	.149
86	18	.162	.150				.156	!!	.146	.161				.147
86	19			.156		.136	.139	!!			.121		.180	.156
86	20	.109	.128	.140		.144	.122	!!	.106	.154	.128		.104	.150
86	21			.110		.146	.134	!!			.150		.158	.138
86	22	.191	.116				.122	!!	.093	.159				.142
86	23			.219		.140	.121	!!			.128		.178	.152
86	24	.143	.132				.137	!!	.133	.154				.148
86	25			.115		.114	.124	!!			.171		.139	.128
86	26	.125	.115				.076	!!	.139	.171				.125
86	27			.128		.128	.120	!!			.136		.147	.152
86	28	.127	.082				.109	!!	.138	.158				.148
86	29					.103	.111	!!					.141	.190
86	30	.105	.107				.104	!!	.111	.140				.143
86	31					.093	.103	!!					.132	.140
86	32	.050	.146				.107	!!	.114	.148				.162
86	33			.105		.102	.101	!!			.118		.138	.127
86	34	.139	.066				.091	!!	.122	.172				.136
86	35			.087		.103	.099	!!			.148		.133	.146
86	36	.139	.088				.098	!!	.136	.114				.151
86	37			.126		.079	.083	!!			.124		.131	.142
86	38	.099	.100				.074	!!	.131	.065				.136
86	39			.162		.090	.092	!!			.114		.119	.139
86	40	.115	.084				.070	!!	.147	.146				.134
86	41			.103		.084	.096	!!			.094		.128	.145
86	42	.120	.098				.073	!!	.155	.088				.156
86	43			.054		.076	.054	!!			.137		.138	.145
86	44	.070	.055				.063	!!	.121	.133				.130
86	45			.076		.052	.068	!!			.101		.121	.128
86	46	.075	.030				.063	!!	.135	.123				.148
86	47						.071	!!						.132
86	48	.085	.079				.049	!!	.117	.126				.144
86	49						.057	!!						.152
86	50		.060				.052	!!		.115				.120
86	51			.062		.046	.044	!!			.125		.121	.133
86	52	.029	.077				.057	!!	.105	.099				.121

DMAHTC POLE POSITION VALUES
UNITS: ARC SECONDS

		X POLE (ARCSECS)							Y POLE (ARCSECS)					
YEAR	DAY	30110	30130	30200	30300	30480	30500	!!	30110	30130	30200	30300	34800	30900
86	53			.040		.047	.039	!!			.115		.119	.138
86	54	.075	.086				.030	!!	.111	.116				.153
86	55			.059		.062	.021	!!			.139		.146	.147
86	56	.053	.055				.025	!!	.122	.159				.124
86	57			.038		.029	.028	!!			.129		.129	.133
86	58	.042	.041				.038	!!	.106	.132				.141
86	59			.041		.040	.037	!!			.122		.114	.146
86	60	.024	.007				.009	!!	.144	.109				.160
86	61			.030			.031	!!			.121			.129
86	62	.064	.069				.025	!!	.118	.148				.135
86	63			.032			.014	!!			.120			.151
86	64	.021	.029				.025	!!	.131	.112				.131
86	65						.015	!!						.149
86	66	.033	.003				.011	!!	.132	.120				.151
86	67			.010		.023	.010	!!			.151		.145	.135
86	68	.021	.014				.017	!!	.141	.102				.124
86	69			.028		.001	.011	!!			.118		.140	.137
86	70	.002	.006				.001	!!	.136	.123				.152
86	71			.005		.000	.007	!!			.156		.126	.163
86	72	.032	.004				.001	!!	.145	.122				.155
86	73			.023		.016	.005	!!			.145		.139	.138
86	74	.040	.004				.012	!!	.121	.134				.138
86	75			.027		.012	.005	!!			.116		.139	.144
86	76	.019	.004				.004	!!	.139	.128				.154
86	77			.024		.012	.026	!!			.128		.140	.150
86	78	.023	.001				.023	!!	.130	.129				.134
86	79			.032		.015	.042	!!			.126		.145	.128
86	80	.037	.034				.031	!!	.141	.143				.138
86	81			.014		.009	.023	!!			.157		.154	.147
86	82	.013	.010				.021	!!	.124	.123				.150
86	83			.007		.020	.021	!!			.149		.140	.176
86	84		.017				.037	!!		.157				.154
86	85			.040		.025	.031	!!			.139		.143	.146
86	86	.030	.046				.046	!!	.147	.142				.152
86	87			.043		.026	.016	!!			.121		.159	.166
86	88	.031	.049				.029	!!	.127	.179				.160
86	89			.039		.033	.037	!!			.143		.175	.170
86	90	.033	.023				.051	!!	.146	.157				.144
86	91			.036		.045	.020	!!			.139		.145	.162
86	92	.045	.011				.029	!!	.161	.159				.176
86	93			.032		.055	.033	!!			.187		.167	.157
86	94	.043	.040				.050	!!	.149	.133				.164
86	95			.043		.041	.056	!!			.131		.167	.162
86	96	.086	.055				.062	!!	.148	.149				.174
86	97			.030		.053	.059	!!			.154		.157	.175
86	98	.077	.032				.059	!!	.162	.175				.176
86	99					.053	.052	!!					.163	.166
86	100	.082	.063				.046	!!	.187	.169				.178
86	101					.080	.077	!!					.190	.175
86	102	.081	.083				.079	!!	.170	.171				.152
86	103					.075	.070	!!					.169	.166
86	104	.068	.077				.075	!!	.184	.203				.194

DMAHTC POLE POSITION VALUES
UNITS ARC SECONDS

		X POLE (ARCSECS)							Y POLE (ARCSECS)					
YEAR	DAY	30110	30130	30200	30300	30480	30500	!!	30110	30130	30200	30300	34800	30500
86	105						.060	!!						.180
86	106	.083	.033				.055	!!	.157	.213				.194
86	107						.070	!!						.188
86	108	.052	.103				.075	!!	.178	.174				.199
86	109						.074	!!						.225
86	110	.087	.089				.075	!!	.193	.188				.212
86	111						.072	!!						.186
86	112	.082	.070				.082	!!	.201	.173				.219
86	113					.070	.084	!!					.202	.202
86	114	.087	.091				.095	!!	.208	.199				.210
86	115			.103			.075	!!			.196			.212
86	116	.067	.083				.080	!!	.213	.201				.203
86	117			.079		.079	.096	!!			.198		.204	.226
86	118	.077	.088				.085	!!	.194	.221				.217
86	119			.072		.059	.102	!!			.211		.208	.200
86	120	.064	.057				.088	!!	.203	.233				.224
86	121			.081		.078	.083	!!			.183		.224	.205
86	122	.080	.066				.090	!!	.221	.247				.215
86	123			.079		.087	.080	!!			.221		.229	.239
86	124	.083	.090				.094	!!	.232	.231				.211
86	125			.094		.084	.082	!!			.212		.224	.238
86	126	.073	.122				.080	!!	.240	.256				.237
86	127			.077		.077	.058	!!			.211		.226	.199
86	128	.079	.085				.105	!!	.218	.253				.243
86	129			.101		.080	.102	!!			.236		.231	.254
86	130	.077	.101				.085	!!	.216	.272				.208
86	131			.060		.101	.097	!!			.209		.220	.247
86	132	.081	.083				.087	!!	.227	.267				.248
86	133						.071	!!						.224
86	134	.087	.041				.098	!!	.229	.255				.252
86	135			.096		.076	.091	!!			.205		.266	.242
86	136	.074	.032				.105	!!	.248	.252				.244
86	137			.094		.095	.093	!!			.264		.234	.260
86	138	.061	.103					!!	.270	.272				
86	139			.088		.089	.086	!!			.257		.235	.251
86	140	.085	.121				.092	!!	.241	.280				.261
86	141			.085		.101	.101	!!			.251		.248	.240
86	142	.074	.057				.107	!!	.252	.247				.264
86	143			.108		.122	.086	!!			.226		.239	.272
86	144	.067	.060				.088	!!	.248	.255				.246
86	145			.086		.075	.088	!!			.265		.252	.250
86	146	.077	.078				.093	!!	.268	.256				.274
86	147			.107		.086	.106	!!			.274		.277	.264
86	148	.069	.051				.114	!!	.288	.267				.301
86	149						.077	!!						.254
86	150	.067	.074				.092	!!	.274	.244				.267
86	151			.131		.082	.092	!!			.273		.263	.280
86	152	.087	.081				.082	!!	.260	.258				.282
86	153					.086	.105	!!					.282	.274
86	154	.096	.090				.090	!!	.292	.253				.302
86	155			.113		.101	.068	!!			.312		.279	.277
86	156	.079	.051				.109	!!	.281	.263				.295

DMAHTC POLE POSITION VALUES
UNITS: ARC SECONDS

		X POLE (ARCSECS)							Y POLE (ARCSECS)					
YEAR	DAY	30110	30130	30200	30300	30480	30500	!!	30110	30130	30200	30300	34800	30500
86	157			.083		.093	.092	!!			.273		.278	.294
86	158	.066	.070				.088	!!	.300	.277				.284
86	159			.105		.101	.099	!!			.300		.281	.297
86	160	.073	.047				.079	!!	.288	.305				.298
86	161			.079		.115	.063	!!			.248		.280	.277
86	162	.097	.049				.093	!!	.287	.304				.307
86	163			.091			.061	!!			.345			.306
86	164	.064	.072				.069	!!	.315	.286				.287
86	165			.090		.093	.105	!!			.281		.288	.320
86	166	.073	.080				.075	!!	.324	.268				.302
86	167			.093		.078	.078	!!			.313		.299	.299
86	168	.091	.099				.094	!!	.292	.271				.323
86	169			.081		.084	.054	!!			.295		.317	.296
86	170	.042	.056				.068	!!	.339	.272				.316
86	171			.067		.077		!!			.321		.306	
86	172	.070	.079					!!	.299	.286				
86	173			.095		.083		!!			.315		.315	
86	174	.073	.090				.066	!!	.338	.271				.315
86	175			.071		.077	.040	!!			.318		.333	.332
86	176	.066	.080				.078	!!	.326	.301				.339
86	177						.053	!!						.343
86	178	.062	.069				.032	!!	.336	.303				.317
86	179						.064	!!						.333
86	180	.062	.067				.050	!!	.340	.306				.346
86	181						.048	!!						.340
86	182	.059	.061				.059	!!	.353	.293				.354
86	183						.031	!!						.352
86	184	.054	.059				.052	!!	.339	.315				.343
86	185						.059	!!						.329
86	186	.071	.057				.029	!!	.355	.378				.359
86	187			.053		.055	.038	!!			.329		.349	.343
86	188	.047	.030		.071		.049	!!	.364	.325		.317		.360
86	189			.079		.065	.006	!!			.363		.352	.370
86	190		.051		.046		.045	!!		.370		.362		.357
86	191			.041		.060	.040	!!			.352		.350	.341
86	192	.055	.052		.031		.001	!!	.351	.361		.341		.370
86	193			.054		.056	.035	!!			.359		.359	.369
86	194	.039	.053		.040		.022	!!	.354	.346		.373		.392
86	195			.037		.063	.000	!!			.369		.351	.380
86	196	.027	.060		.066		.021	!!	.364	.367		.351		.357
86	197			.069		.024	.010	!!			.369		.343	.357
86	198	.057	.042		.032		.008	!!	.337	.355		.339		.383
86	199			.047		.048	.050	!!			.361		.358	.367
86	200	.041	.017		.030		.007	!!	.350	.379		.349		.389
86	201			.054		.034	.016	!!			.366		.364	.365
86	202	.040	.076		.015		.023	!!	.373	.368		.369		.364
86	203			.020		.035	.029	!!			.377		.373	.387
86	204	.035	.035		.047		.002	!!	.371	.384		.340		.385
86	205			.031		.039	.018	!!			.392		.371	.386
86	206	.044	.014		.028		.002	!!	.384	.379		.389		.398
86	207			.019		.000	.004	!!			.392		.366	.370
86	208	.030	.038		.041		.019	!!	.370	.372		.354		.364

DMAHTC POLE POSITION VALUES
UNITS: ARC SECONDS

		X POLE (ARCSECS)							Y POLE (ARCSECS)					
YEAR	DAY	30110	30130	30200	30300	30480	30500	!!	30110	30130	30200	30300	34800	30500
86	209			.038		.029	.023	!!			.377		.381	.382
86	210	.021	.040		.016		.009	!!	.360	.376		.375		.389
86	211			.002		.021	.009	!!			.407		.377	.386
86	212	.022	.021		.014		.023	!!	.363	.364		.390		.395
86	213			.029		.018	.008	!!			.387		.374	.367
86	214	.029	.010		.027		.026	!!	.375	.365		.379		.391
86	215			.035		.015	.025	!!			.370		.390	.390
86	216	.002	.033		.017		.010	!!	.373	.373		.353		.376
86	217			.018		.018	.033	!!			.376		.380	.406
86	218	.015	.013		.011		.036	!!	.363	.382		.368		.388
86	219			.020		.016	.003	!!			.384		.390	.379
86	220	.032	.021		.010		.022	!!	.349	.388		.371		.385
86	221			.025		.000	.024	!!			.365		.393	.377
86	222	.007	.009		.008		.015	!!	.401	.392		.410		.375
86	223			.020		.014	.019	!!			.392		.381	.384
86	224	.015	.014		.010		.021	!!	.372	.392		.388		.377
86	225			.003		.003	.002	!!			.404		.388	.381
86	226	.016	.025		.007		.046	!!	.366	.394		.364		.373
86	227			.015		.013	.010	!!			.393		.391	.387
86	228	.002	.013		.003		.014	!!	.372	.392		.390		.374
86	229			.004		.001	.049	!!			.377		.384	.397
86	230	.021	.015		.007		.005	!!	.378	.378		.367		.377
86	231			.026		.015	.032	!!			.377		.395	.372
86	232	.001	.022		.005		.057	!!	.393	.393		.395		.394
86	233			.003		.006	.021	!!			.408		.394	.384
86	234	.029	.004		.007		.046	!!	.385	.405		.403		.385
86	235			.009		.010	.057	!!			.392		.392	.382
86	236	.027	.048		.020		.009	!!	.382	.394		.415		.393
86	237			.011		.025	.040	!!			.400		.397	.387
86	238	.028	.009		.030		.047	!!	.372	.406		.385		.392
86	239			.052		.024	.017	!!			.411		.402	.385
86	240	.038	.017		.029		.058	!!	.395	.392		.380		.408
86	241			.019		.018	.057	!!			.405		.395	.400
86	242	.078	.041		.017		.037	!!	.388	.393		.391		.391
86	243			.034		.035	.064	!!			.403		.410	.390
86	244	.037	.012		.023		.036	!!	.398	.393		.392		.391
86	245			.040		.029	.048	!!			.406		.406	.380
86	246	.017	.012		.014		.071	!!	.415	.391		.428		.386
86	247			.041		.026	.044	!!			.405		.386	.398
86	248	.030	.029		.020		.033	!!	.412	.399		.411		.373
86	249			.025		.042	.050	!!			.427		.412	.375
86	250	.077	.056		.053		.035	!!	.385	.394		.407		.378
86	251			.025		.045	.071	!!			.424		.393	.385
86	252	.040	.047		.039		.066	!!	.390	.399		.402		.381
86	253			.041		.032	.051	!!			.406		.402	.375
86	254	.058	.046		.014		.065	!!	.386	.383		.392		.398
86	255			.024		.035	.040	!!			.417		.414	.390
86	256	.065	.044		.020		.053	!!	.415	.402		.399		.381
86	257			.079		.035	.072	!!			.411		.398	.375
86	258	.058	.084		.043		.089	!!	.412	.413		.413		.397
86	259			.028		.041	.043	!!			.418		.408	.376
86	260	.040	.050		.035		.073	!!	.411	.412		.421		.387

DMAHTC POLE POSITION VALUES
UNITS: ARC SECONDS

		X POLE (ARCSECS)							Y POLE (ARCSECS)					
YEAR	DAY	30110	30130	30200	30300	30480	30500	!!	30110	30130	30200	30300	34800	30500
86	261			.085		.046	.061	!!			.412		.407	.384
86	262	.087	.048		.053		.045	!!	.382	.417		.387		.366
86	263			.046		.038	.079	!!			.415		.387	.366
86	264	.055	.034		.042		.044	!!	.374	.420		.404		.379
86	265			.097		.051	.054	!!			.413		.408	.374
86	266	.110	.047		.039		.069	!!	.366	.388		.398		.385
86	267			.069		.057	.064	!!			.424		.412	.366
86	268	.097	.034		.058		.076	!!	.398	.409		.376		.383
86	269			.091		.048	.083	!!			.409		.389	.388
86	270	.070	.059		.068		.067	!!	.421	.391		.410		.403
86	271			.065		.065	.063	!!			.406		.402	.373
86	272	.060	.066		.052		.095	!!	.395	.397		.424		.390
86	273			.101		.049	.051	!!			.365		.416	.350
86	274	.099	.075		.045		.081	!!	.412	.404		.404		.375
86	275			.083		.065	.077	!!			.421		.388	.413
86	276	.081	.066		.082		.059	!!	.390	.396		.403		.395
86	277			.059		.073	.093	!!			.376		.411	.378
86	278	.057	.088		.094		.065	!!	.410	.391		.382		.365
86	279			.103		.054	.062	!!			.394		.409	.351
86	280	.089	.085		.073		.093	!!	.398	.384		.423		.357
86	281			.078		.077	.079	!!			.371		.396	.390
86	282	.097	.044		.012		.073	!!	.405	.385		.399		.380
86	283			.093		.079	.088	!!			.389		.401	.377
86	284	.075	.083		.094		.066	!!	.404	.394		.381		.352
86	285			.077		.071	.090	!!			.378		.405	.372
86	286	.113	.133		.093		.124	!!	.410	.391		.422		.371
86	287			.120		.088	.084	!!			.405		.402	.401
86	288	.103	.106		.090		.096	!!	.398	.388		.384		.363
86	289			.090		.088	.097	!!			.416		.406	.362
86	290	.081	.067		.122		.096	!!	.396	.376		.407		.377
86	291			.118		.093	.115	!!			.389		.397	.355
86	292	.105	.099		.116		.110	!!	.396	.380		.410		.389
86	293			.120		.100	.091	!!			.401		.401	.379
86	294	.105	.111				.095	!!	.403	.393				.360
86	295			.107		.102	.112	!!			.381		.388	.355
86	296	.089	.085		.113		.090	!!	.411	.389		.376		.363
86	297			.110		.078	.114	!!			.405		.388	.387
86	298	.089	.120		.104		.117	!!	.401	.403		.377		.386
86	299			.106		.114	.083	!!			.384		.400	.369
86	300	.120	.115		.150		.120	!!	.399	.377		.398		.364
86	301			.116		.105	.101	!!			.395		.409	.370
86	302	.122	.140		.131		.094	!!	.402	.397		.383		.357
86	303			.111		.103	.117	!!			.366		.366	.384
86	304	.092	.107		.108		.109	!!	.396	.381		.380		.380
86	305			.132		.109	.103	!!			.401		416	.363
86	306	.119	.124		.119		.131	!!	.391	.379		.379		.360
86	307			.123		.113	.108	!!			.394		.395	.377
86	308	.131	.133		.132		.110	!!	.400	.397		.385		.365
86	309			.130		.120	.147	!!			.405		.385	.388
86	310	.093	.115		.128		.110	!!	.385	.391		.363		.372
86	311			.126		.120	.113	!!			.397		.404	.353
86	312	.115	.127		.142		.125	!!	.393	.390		.378		.371

DMAHTC POLE POSITION VALUES
UNITS: ARC SECONDS

		X POLE (ARCSECS)							Y POLE (ARCSECS)					
YEAR	DAY	30110	30130	30200	30300	30480	30500	!!	30110	30130	30200	30300	34800	30500
86	313			.128		.103	.095	!!			.391		.407	.362
86	314	.139	.143		.128		.142	!!	.384	.367		.404		.347
86	315			.137		.120	.138	!!			.395		.374	.358
86	316	.089	.128		.128		.121	!!	.386	.366		.396		.360
86	317			.119		.133	.126	!!			.388		.375	.346
86	318	.115	.110		.106		.113	!!	.369	.378		.375		.345
86	319			.138		.116	.105	!!			.384		.393	.374
86	320	.124	.138		.137		.154	!!	.379	.371		.362		.355
86	321			.125		.126	.104	!!			.406		.372	.369
86	322	.109	.133		.145		.111	!!	.391	.354		.370		.351
86	323			.157		.145	.134	!!			.387		.376	.346
86	324	.100	.131		.156		.109	!!	.369	.369		.355		.355
86	325			.146		.117	.131	!!			.397		.387	.363
86	326	.123	.130		.121		.123	!!	.361	.364		.362		.358
86	327			.136		.129	.094	!!			.334		.389	.367
86	328	.099	.138		.133		.129	!!	.353	.355		.378		.340
86	329			.150		.131	.145	!!			.348		.370	.345
86	330	.108	.117		.137		.110	!!	.354	.352		.370		.359
86	331			.130		.124	.141	!!			.363		.360	.356
86	332	.128	.115		.116		.123	!!	.359	.367		.357		.360
86	333			.140		.124	.123	!!			.375		.367	.359
86	334	.104	.158		.139		.141	!!	.373	.354		.343		.344
86	335			.121		.120	.111	!!			.365		.357	.359
86	336	.101	.150		.131		.126	!!	.349	.381		.353		.343
86	337			.148		.130	.134	!!			.362		.354	.361
86	338	.120	.139		.130		.107	!!	.345	.390		.350		.350
86	339			.095		.123	.114	!!			.396		.369	.334
86	340	.141	.138		.114		.111	!!	.348	.385		.354		.356
86	341			.147		.130	.119	!!			.362		.350	.331
86	342	.102	.149		.112		.135	!!	.342	.383		.363		.355
86	343			.161		.154	.150	!!			.354		.350	.352
86	344	.104	.163		.157		.122	!!	.335	.324		.319		.346
86	345			.140		.136	.112	!!			.339		.364	.327
86	346	.131	.144		.139		.119	!!	.348	.343		.350		.345
86	347			.129		.142	.126	!!			.371		.351	.354
86	348	.117	.130		.143		.152	!!	.346	.340		.329		.353
86	349			.142		.142	.148	!!			.372		.343	.343
86	350	.099	.167		.121		.128	!!	.343	.362		.344		.322
86	351			.138		.140	.105	!!			.364		.349	.328
86	352	.126	.158		.128		.106	!!	.295	.363		.364		.357
86	353			.139		.127	.137	!!			.327		.346	.341
86	354	.139	.149		.116		.134	!!	.333	.345		.305		.339
86	355			.152		.146	.137	!!			.319		.338	.324
86	356	.123	.139		.170		.128	!!	.306	.319		.320		.315
86	357			.151		.155	.128	!!			.340		.349	.315
86	358	.133	.177		.145		.141	!!	.315	.331		.348		.326
86	359			.143		.137	.141	!!			.334		.343	.339
86	360	.137	.133		.165		.147	!!	.332	.319		.340		.343
86	361			.134		.154	.137	!!			.339		.314	.329
86	362	.132	.154		.140		.135	!!	.328	.307		.320		.323
86	363			.180		.162	.154	!!			.314		.328	.322
86	364	.123	.165		.170		.141	!!	.310	.329		.321		.315

OMAHTC POLE POSITION VALUES
UNITS: ARC SECONDS

		X POLE (ARCSECS)							Y POLE (ARCSECS)					
YEAR	DAY	30110	30130	30200	30300	30480	30500	!!	30110	30130	30200	30300	34800	30500
86	365			.143		.127	.126	!!			.307		.351	.326

DISTRIBUTION LIST

HQ DMA
- ATTN: PR (Mr. Russman) 1 cy
- ATTN: RET (Dr. Fell) 1 cy
- ATTN: REG (Dr. Smith) 1 cy
- ATTN: AO (Ms. Campbell) 1 cy

DMAHTC Geodetic Survey Squadron
- ATTN: GSST (Mr. Rowe) 1 cy

DMAHTC
- ATTN: PPTE (Mr. Anderson) 1 cy
- ATTN: RET (Dr. Wooden) 1 cy
- ATTN: GSG 2 cy
- ATTN: GSGT 2 cy
- ATTN: GST 2 cy
- ATTN: GSGS 2 cy
- ATTN: GSGA 2 cy
- ATTN: GSM 2 cy
- ATTN: GS 2 cy
- ATTN: GSFA 2 cy
- ATTN: GSGC 20 cy

Bureau International de l'Heure
ATTN: (Dr. Feissel)
75014 Paris, France 1 cy

IAGS
ATTN: TDS (Mr. Caddess) 1 cy

Jet Propulsion Laboratory
ATTN: Dr. Melbourne
Pasadena, CA 91109 1 cy

Massachusetts Institute of Technology
ATTN: MS 54-620 (Dr. King)
Cambridge, MA 02139 1 cy

National Geodetic Survey
ATTN: Dr. Remondi
Rockville, MD 20878 1 cy

Naval Surface Weapons Center
ATTN: Mr. Hill
Dahlgren, VA 22448 3 cys

Royal Greenwich Observatory
ATTN: Dr. Wilkins
Hailsham, East Sussex,
England BN27 1 RP 1 cy

US Naval Observatory
ATTN: Time Service
(Dr. McCarthy) 1 cy
Washington, DC 20309-5400

The University of Texas at Austin
ATTN: WRW 402 (Dr. Shutz)
Austin, TX 78712-1085 1 cy

END

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